MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1 2022/2023 (TERM ID 2210)

EEE3156 – DIGITAL SYSTEM

13 February 2023

9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTION TO STUDENTS

1. This Question paper consists of **4 pages** including cover page with **4 Questions** only.

2. Attempt **ALL FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is the same.

3. Please print all your answers in the answer Booklet provided.

Question 1:

(a) Create the truth tables of the following functions A and B.

$A(w, x, y, z) = \sum m(1, 3, 7, 8, 9, 12, 13, 15)$

$B = w\bar{x}yz + \bar{w}xy\bar{z} + wxy\bar{z} + \bar{w}x\bar{y}z + \bar{w}\bar{x}\bar{y}z + wx\bar{y}z + \bar{w}\bar{x}yz$

[4 marks]

(b) From part (a) above, compute the simplified characteristic equations of functions A and B.

[8 marks]

(c) From part (b), implement the functions A and B using:-

(i) Standard logic gates only.

(ii) Pure NAND gates only.

[6+7 marks]

Question 2:

(a) Compute the characteristic equations of the output signals (F1 until F6) for the circuit shown in Figure Q2.

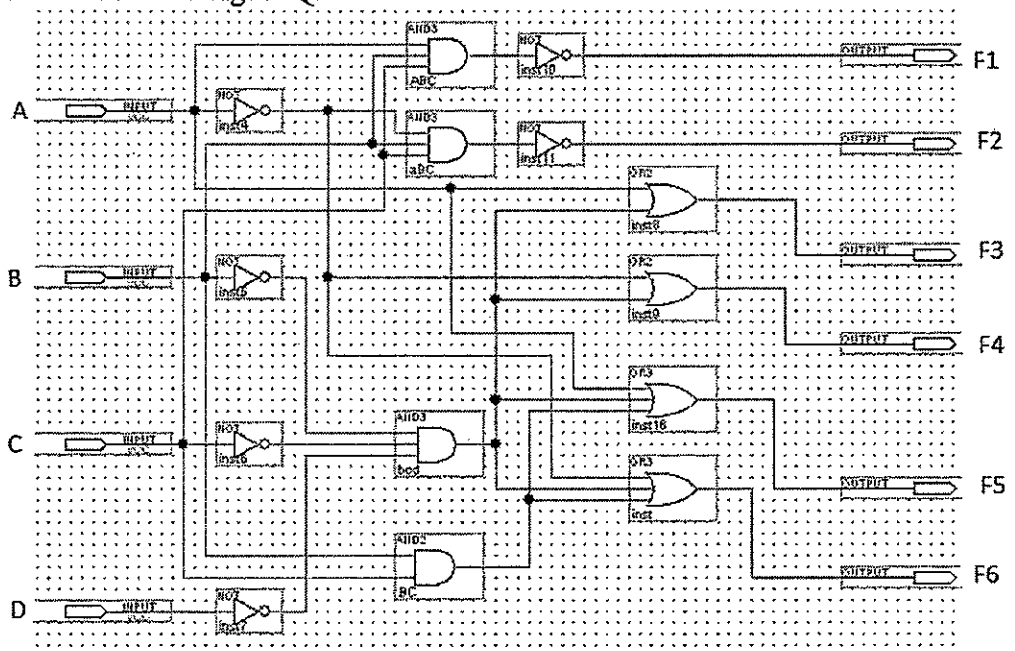

Figure Q2

[12 marks]

(b) Design the system shown in Figure Q2 using the programmable logic array.

[13 marks]

Continued ...

Question 3:

(a) Create a state assigned table for a 3-bit counter with the corresponding output signals shown in Figure Q3(a). The input and the output signals of the 3-bit counter are shown in Figure Q3(b).

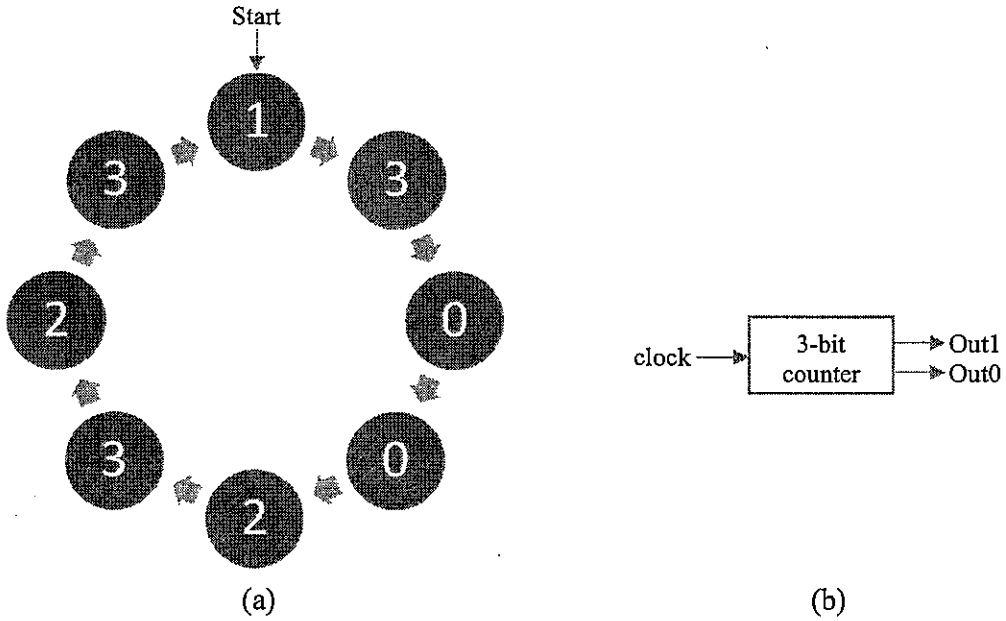

Figure Q3

[8 marks]

(b) Compute the simplified characteristic equations for the 3-bit counter in part (a).

[10 marks]

(c) From part (b), design the 3-bit counter using logic gates and D flip-flops.

[7 marks]

Continued ...

Question 4:

Figure Q4 shows a single bit Arithmetic and Logic Unit (ALU) and Table Q4 shows the operations of the ALU.

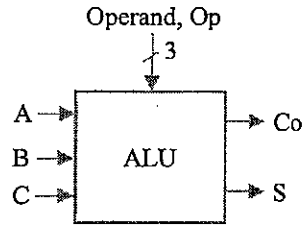

Figure Q4

Table Q4

Operand Op2 Op1 Op0	Operations
000	S = NOT A, Co = A
001	S = NOT B, Co = B
010	S = A AND B, Co = A AND B AND C
011	S = A NAND B, Co = A NAND B NAND C
100	S = A OR B, Co = A OR B OR C
101	S = A NOR B, Co = A NOR B NOR C
110	S = A XOR B, Co = A XNOR B
111	Co S = A plus B plus C

(a) Design a single-bit adder to perform the arithmetic operation shown in Figure Q4 using standard logic gates only.

[13 marks]

(b) From part (a), design the overall circuit of the single bit ALU using standard logic gates and multiplexer only.

[12 marks]

End of Paper